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Chapter 4: Environmental Consequences

Impacts on Cultural Resources

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IMPACTS ON CULTURAL RESOURCES

ISSUES

Cultural resources include archeological and historic properties, as well as traditional cultural properties, ethnographic resources, and cultural landscapes. Impacts from visitation pose a serious threat to these resources, given that they are generally irreplaceable and nonrenewable. Numerous issues have been identified regarding cultural issues, both in public scoping and in internal review. The primary issues are described below.

- Public education and appreciation for cultural resources can have unintended consequences for the integrity of the property. Visitors have expressed a desire for increased information and access to cultural resources; some visitors, however, have suggested that access to cultural resources be restricted.
- Visitor access to popular cultural resources (i.e. attraction sites) can inadvertently disturb significant features, thereby limiting the ability of the site to convey its meaning. Hardening site surfaces and creating trails, while providing access, can be detrimental to the resource.
- Limited availability of campsites and off-river hiking trails to and near cultural resource attraction sites may impact the integrity and significance of cultural resources. When larger groups visit cultural resources, they have greater potential to inadvertently disturb features, artifacts, and traditional cultural areas by their inability to stay on established trails, which are created for single-file movement. Congestion in resource areas can lead to unintentional trampling of important cultural features.

GUIDING REGULATIONS AND POLICIES

Impacts to cultural resources (archeological sites, historic and prehistoric structures, cultural landscapes, ethnographic resources) are described in terms of type, context, duration, and intensity, which is consistent with CEQ regulations for implementing the National Environmental Policy Act. The following impact analyses are intended, however, to also comply with the requirements of section 106 of the National Historic Preservation Act. In accordance with the regulations of the Advisory Council on Historic Preservation (ACHP) implementing this section (36 CFR Part 800), impacts to cultural resources were identified and evaluated by (1) determining the area of potential effect; (2) identifying cultural resources present in the area of potential effect that are either listed on or eligible for listing on the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources that are either listed on or eligible for the national register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the ACHP regulations a determination of either adverse effect or no adverse effect must also be made for affected cultural resources that are eligible for the national register. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion on the register, e.g., diminishing of the integrity of the

resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by the alternative but that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5). A determination of no adverse effect means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for the National Register of Historic Places.

CEQ regulations and DO #12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in the intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under the National Environmental Policy Act only. It does not suggest that the level of effect as defined by section 106 of the National Historic Preservation Act is similarly reduced. Even though adverse effects under section 106 may be mitigated, the effect remains adverse.

According to the NPS *Management Policies 2001,* "planning decisions will follow analysis of how proposals might affect the values that make resources significant, and the consideration of alternatives that might avoid or mitigate potential adverse effects. Planning will always seek to avoid harm to cultural resources, and consider the values of traditionally associated groups." Additionally, planning efforts must include consultation with cultural resource specialists, traditionally associated peoples, and other stakeholders, as appropriate.

MANAGEMENT OBJECTIVES FOR CULTURAL RESOURCES

Management objectives for the *General Management Plan,* as well as the *Colorado River Management Plan,* are included in Chapter 1. The objectives for cultural resources as they relate to management of recreational river use in the Grand Canyon are as follows:

- Maintain the integrity of all significant cultural resources, with site preservation the optimal condition. If preservation is not possible, slow the rate at which their essential material qualities are lost.
- Provide opportunities for present and future populations to understand, experience, and reflect the human history as evidenced through cultural resources in and near the river corridor while protecting them from adverse effects from visitation.
- Preserve the integrity and condition of cultural resources and provide opportunities for traditional access by affiliated American Indian tribal members.

How well each alternative would meet these management objectives is described in Table 2-4 and Table 2-7 in Chapter 2.

METHODOLOGY FOR ANALYZING EFFECTS TO CULTURAL RESOURCES

The inventory and monitoring of cultural resources is an ongoing project for NPS staff and Hualapai tribal staff. Although the systematic monitoring of accessible sites to quantify and

document the level of visitation or impact has not been possible, cultural resource personnel do assess and record impacts whenever they have the opportunity. The sites that have been recorded and monitored represent those sites that, for the most part, are known and have received visitation; however, only 3% of the estimated number of cultural sites in the Grand Canyon have been inventoried and only a fraction of these have been formally assessed for visitor impacts. Consequently, many of the 3% of recorded sites are in heavily visited areas such as the river corridor, side canyons, canyon rims, and other areas developed for recreational use. Currently, the principal source of data for the mainstem is the River Corridor Monitoring and Treatment Program, which was created in 1992 under a multi-agency/tribal programmatic agreement to monitor cultural sites potentially affected by operations of Glen Canyon Dam.

In order to analyze the effect of each alternative on cultural resources, all available information on known archeological sites, historic properties, traditional cultural properties, and other ethnographic resources was compiled from NPS and Hualapai Tribe cultural resource files. A map with locations of known cultural and natural resources and visitor stopping points (campsites, lunch sites, and attraction sites), including data on use intensity, resulted in the identification of areas of resource concern, in which concentrations of sensitive resources overlapped with visitor use areas. Predictions about visitor impacts were based on data from the Grand Canyon river trip simulator program, predicted use levels from the simulator program, and the River Corridor Monitoring and Treatment Program.

The analysis of impacts was based on the interaction of context, duration, timing, and intensity of visitor impacts. Intensity of impacts, both regional and local, was defined using resource-specific impact thresholds. This method, which assumed that all documented historic and traditional cultural properties are considered eligible for the National Register of Historic Places as contributors to the overall Grand Canyon multiple-property listing, yielded an impact analysis that integrated determination of effect. Key terms for this analysis are defined below.

As defined in the NPS *Cultural Resource Management Guideline* (NPS 1998d), cultural landscapes are settings that humans have created in the natural world. By definition, cultural landscapes do no exist along the Colorado River. While historic vernacular landscapes do exist at both Lees Ferry and Phantom Ranch, none of the alternatives would affect these areas. Therefore, impacts to cultural landscapes will not be analyzed in this document. Furthermore, because archeological sites, historic and prehistoric structures, and ethnographic resources are all similarly affected by crowding, accessibility, increases in user discretionary time and other variables related to management of recreational use on the river, these resources are analyzed as a group. When analysis identified distinctions in impacts between these resources, they are detailed in the text.

IMPACT THRESHOLDS

The general process for assessing impacts to the environment is discussed in the "Introduction" to Chapter 4. Effects specific to cultural resources are characterized for each alternative based on the impact thresholds presented below. Additionally, each alternative was evaluated to determine whether effects are direct or indirect. The following intensity descriptions reflect evaluations

consistent with those described by the Advisory Council on Historic Preservation (36 CFR 800) relative to applying the criteria of effect.

Intensity

Negligible — Change cannot be measured. Depletion or displacement of elements is barely perceptible. The determination of effect for section 106 (36 CFR 800) would be no adverse effect.

Minor — Adverse: For archeological resources / historic properties, impacts would be detectable but would not diminish the overall integrity of the resource. Impacts such as social trailing, feature degradation, artifact depletion and displacement, and sediment compaction could occur and would be measurable but would be localized and would not result in changes to defining elements and would not affect or jeopardize defining features or characteristics or aspects of integrity that contribute to eligibility for the National Register of Historic Places. The determination of effect for section 106 would be no adverse effect.

For cultural landscapes, impacts would be detectable but would not affect a character-defining pattern(s) or feature(s) of a landscape listed on or eligible for the national register. The determination of effect on cultural landscapes for section 106 would be no adverse effect.

For ethnographic resources, impacts would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. The determination of effect on traditional cultural properties for section 106 would be no adverse effect.

Beneficial: Effects would be measurable and localized, resulting in increased stability to character defining features.

Moderate — Adverse: For archeological resources / historic properties, disturbance of a site or sites would result in the loss of overall integrity, but not to the extent that a site's national register eligibility would be jeopardized. Impacts would include measurable change to character-defining elements and would contribute to increased instability of site landscape. Impacts would require stabilization of eroding sediments and reduction in social trailing, artifact displacement, and trampling outside of established trails. The determination of effect for section 106 would be an adverse effect. A memorandum of agreement would be executed among the National Park Service and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation, in accordance with 36 CFR 800.6(b).

For cultural landscapes, impacts would alter a character-defining pattern(s) or feature(s) of the cultural landscape, but would not diminish the integrity of the landscape to the extent that its national register eligibility was jeopardized. The determination of effect on cultural landscapes for section 106 would be an adverse effect.

For ethnographic resources, impacts would be apparent and would alter resource conditions or interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the

group's practices and beliefs would survive. The determination of effect on traditional cultural properties for section 106 would be an adverse effect.

Beneficial: Effects would be measurable and contribute to increased stability of site landscape (e.g., stabilization of eroding sediments; reduction in social trailing, artifact displacement, and trampling outside of established trails).

Major — Adverse: For archeological resources / historic properties, disturbance of a site or sites would result in the loss of overall integrity and significant change to character-defining elements to the extent that it would no longer be eligible to be listed on the national register. Impacts would include destabilization of structures or cultural contexts, depletion or displacement of artifact assemblages, and an increase in exposure or vulnerability to natural elements. The determination of effect for section 106 would be an adverse effect.

For cultural landscapes, impacts would alter a character-defining pattern(s) or feature(s) of the cultural landscape to the extent that it would no longer be eligible to be listed on the national register. The determination of effect on cultural landscapes for section 106 would be adverse effect.

For ethnographic resources, impacts would alter resource conditions, or block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. Impacts would result in significant changes or destabilization to defining elements and resource condition and an increase in exposure or vulnerability to natural elements. The determination of effect on traditional cultural properties for section 106 would be adverse effect.

Beneficial: Effects would be measurable and result in the stabilization of site features, landscape, artifact assemblages, setting, and sediments (e.g., the elimination of social trailing, artifact displacement, and trampling outside of established trails; restoration of site setting through elimination of invasive species).

Context

Localized — Impacts would be restricted to specific sites.

Regional — Impacts would occur to several specific resource sites within a management zone. This might also include impacts to a site that has regional significance.

Duration

Short term — An effect that, within five years, would no longer be detectable as the resource was returned to its predisturbance condition or appearance (e.g. trash and other items that could be removed or vegetation that has been trampled, but the has not been denuded).

Long term — A change in a resource or its condition that would not return the resource to predisturbance condition or appearance and for all practical purposes would be considered permanent (e.g., damage to elements or removal of artifacts)

Timing

Trailing on archeological sites may be more pronounced during the spring growing season, as trampling young vegetation may lead to increased trailing and soil compaction. Also, some ethnographic resources might be more vulnerable to impacts during the spring growing season or at other times of the year depending on specific tribal traditions.

MITIGATION OF EFFECTS

Previous mitigation efforts indicate that specific measures can be effective in deterring increased damage of sites due to visitor impacts; however, to sustain current mitigation levels more staff is needed to maintain the completed work. Maintenance is the key to a good preservation-based mitigation program. Reasonable mitigations for impacts to cultural resources include the following:

- monitoring of visitor impacts relative to baseline conditions
- hardening of popular sites, including creation of formal trails
- revegetation of areas damaged by social trailing
- placement of check-dams in areas where social trails have become watercourses
- increased education of visitors in leave-no-trace ethics
- stabilization of damaged features and landscapes
- graffiti removal
- active management (guides, education, interpretive trails and signs) of popular sites
- planned research and excavation
- restrictions on group sizes or numbers of trips allowed at certain sites
- temporary or permanent closures of exceptionally vulnerable sites
- strict enforcement of the Archeological Resources Protection Act (including increased enforcement staffing)
- measures to improve traditional access and accommodate traditional practices
- temporary closure of ethnographic sites to nontraditional visitation

CUMULATIVE IMPACTS

Cumulative impacts on cultural resources were determined by combining the impacts of each alternative with other past, present, and reasonably foreseeable future actions (see the "Introduction" to Chapter 4 for detailed list of all actions).

The most significant action that has affected, and will continue to affect, the cultural resources along the mainstem of the Colorado River is the operation of Glen Canyon Dam. Regulated flows of clear water and the lack of sediment inputs have eroded pre- and post-dam river terraces that have long held important archeological sites. Because very little sediment remains in the Colorado River below Glen Canyon Dam, existing terraces and sediment deposits are no longer replaced. Sites thus become more vulnerable to impacts from visitation as the sediments that

stabilized cultural resources erode away. This impact affects only those sites located on terraces of the Colorado River. Impacts from the dam result in localized, long-term, year-round, minor to moderate effects to these sites. Side canyon sites are unaffected by dam operations.

Previous visitation has also negatively affected cultural resources. These impacts include artifact displacement, feature damage, trampling, and erosion from social trails that have turned into watercourses. Research activities have also contributed to the effects from visitation. Because most cultural resources are nonrenewable, even small incidents of visitation can diminish the resource. These losses happen generally in the high-use season, are site specific, and result in an adverse, long-term, minor to moderate effect.

SECTION 106 SUMMARY

In accordance with the NPS "Servicewide Programmatic Agreement" and the "Grand Canyon National Park Draft General Management Plan Programmatic Agreement," both of which provide a framework for compliance with section 106 of the National Historic Preservation Act, the National Park Service conducted an assessment of effects for the implementation of the *Colorado River Management Plan.* Regulations of the Advisory Council on Historic Preservation (36 CFR Part 800.8(c)) allow for agencies to use the NEPA process to comply with section 106 "in lieu of the procedures set forth in §800.3 through 800.6." When this project was initiated, it was indicated that the NEPA process would be conducted in a manner that would serve as an adequate substitute for the section 106 process. Additionally the park identified and consulted with the public, as well as appropriate agencies, stakeholders, and American Indian Tribes in a manner consistent with 36 CFR 800.3(f) (see Chapter 5). Development and analysis of alternatives was based largely on these consultations. In accordance with 36 CFR 800.4 through 800.5, thresholds for determining impacts to cultural resources were crafted based on predicted changes to elements of integrity and how those changes may affect National Register of Historic Places eligibility.

The Grand Canyon and its side canyons hold a wealth of cultural resources, including historic and prehistoric archaeological sites, traditional cultural places, and cultural landscapes. Previous impacts from visitation have been documented in archaeological sites both along the river and in the side canyons.

A review of the Grand Canyon cultural resource files has yielded data on prior studies and recorded cultural resources within the area of potential effect (see Chapter 3); these data provided background information for this environmental impact statement. Cultural resources along the river corridor have been inventoried and monitored by park staff as part of ongoing program management and in response to compliance needs of the Glen Canyon Dam environmental impact statement process. A formal monitoring program of effects from Glen Canyon Dam operations was implemented in 1992 as a result of the *Glen Canyon Dam Final Environmental Impact Statement.* Numerous sites have been identified outside the river corridor itself, part of opportunistic and judgmental inventories in the park. Systematic survey of these areas has not occurred. The environmental impact analysis process for this revision to the *Colorado River Management Plan* used existing inventory and monitoring information for cultural resources evaluations. This impact analysis indicates that archeological survey and monitoring may be an

appropriate strategy to refine the inventory during implementation of the selected alternatives. In cases where it was determined there was a potential for adverse impacts to cultural resources listed on or eligible for listing on the National Register of Historic Places, the National Park Service would coordinate with the Arizona state historic preservation officer to determine the level of effect on the property and the needed mitigation measures. Additionally, because implementation of the management plan may have an adverse effect on significant cultural resources, a memorandum of agreement with the Arizona State Historic Preservation Office and the Hualapai Tribe, among others, will be instituted in accordance with 36 CFR 800.6.

ASSUMPTIONS

General assumptions used for the analysis of effects for each alternative are discussed in the "Introduction" to Chapter 4. Assumptions that specifically relate to the alternatives discussed in this document and their effect on cultural resources are presented below:

- Variables that contribute to congestion (e.g., group sizes, trip length, numbers of passengers, user discretionary time) contribute to the vulnerability of cultural resources. However, the interaction of the all variables taken together must be evaluated as a whole.
- Mode of travel (i.e., motor vs. oar) and trip type (i.e., commercial vs. noncommercial) are thought to have no effect on cultural resources. The only exception may be in the effect of motorized use related to noise on traditional cultural properties.
- On longer trips visitors have increased amounts of time to interact with the canyon environment and the potential for greater access to sensitive cultural resources. This is particularly true for side canyons, as longer trips are designed to allow visitors this type of opportunity. Off-season hiking (during shoulder and winter months) is more conducive to exploring side canyons, as the extreme heat of the summer precludes hiking too far from the river itself.
- Ongoing sediment depletion in the river corridor due to Glen Canyon Dam have a long-term, cumulative effect on a number of variables related to visitor access and use of the river corridor. Size and distribution of camping beaches has the potential to affect visitation to sensitive cultural resources by changing visitor use patterns, camping locations, and hiking trails. As the distribution and size of beaches diminishes, visitors may be forced to camp in old high-water zone topography, places where cultural site densities are the greatest. This is particularly true for larger groups, as the number and distribution of large camps has been most affected by the diminishing beaches along the river. Sediment depletion has also led to increased visibility of cultural sites, thereby making them more vulnerable to damage from visitation. Likewise, ongoing depletion has made it impossible for annual spring floods, which were previously sediment laden, to rebuild river terraces and bury or stabilize cultural resources.
- The majority of archeological sites along the mainstem and side canyons represent limited occupation by small groups of people, typically nuclear or extended family groups, residing at a site for portions of a given year. These sites, by their very nature, are relatively small, with structures and artifact areas visible on the surface. Visitation to these sites, while an important component of the visitor experience, can be damaging. Smaller groups tend to be able to keep to established walking areas and congregation areas, while

large groups may have more impacts than small groups when visiting small, confined archeological sites in the canyon's backcountry (Monz et al. 2000). Additionally, visitors concentrated at a few sites may intensify impacts at these attractions while effectively limiting visitation at other locations.

- Passenger exchanges at Whitmore bring new visitors to the river corridor, essentially requiring that these visitors are educated about how to protect canyon resources. Cultural resources below Whitmore have seen increased use, mirroring the increase in exchanges, often requiring increased management action on the part of the Park (Hubbard et al. 2001, Bulletts 1996).
- Not all visitor impacts to cultural resources in the river corridor are from river runners; backcountry users and anglers contribute to impacts in areas that offer reasonable access. For example, angler sites, which are generally located at points of easy access just below Lees Ferry and in upper Marble Canyon, are easily distinguished by tackle, beverage cans, and fish entrails.
- Resources of concern to the affiliated tribes are generally described as archeological sites, locations mentioned in tribal histories, specific plant collection locations, mineral deposits, and spring sources. Over 100 separate places of importance have been identified in the reports generated by the tribes for resources along the Colorado River (Ferguson 1998; Jackson 1994; Stevens 1996; Roberts, Begay, and Kelley 1995; Stoffle et al. 1994; Stoffle, Austin et al. 1995; Stoffle, Loendorf et al. 1995; Hart 1995). While most resources are considered "natural resources" by western scientific standards, they are very much considered cultural resources from a tribal perspective. Specific information related to impacts on natural (i.e., biological) resources that are also considered cultural resources can be found in the "Natural Resources" section of this chapter.

IMPACT ANALYSIS — LEES FERRY ALTERNATIVES

Key variables, indicators, and use estimates for the Lees Ferry alternatives (Table 4-1 and Table 4-2) were used to determine changes in use at specific resource sites and projected seasonal changes in use patterns. Because no direct evidence has been collected that links specific use variables (group size, trip length, etc.) to levels and types of visitor impacts, various projected use estimates serve as the basis for assessing potential impacts. Additionally, Table 4-26 estimates projected visitation at the Little Colorado River confluence and Deer Creek, based on the river trip simulator. This table was used to estimate changes in crowding at two attraction sites that are also traditional cultural properties.

TABLE 4-26: PROJECTED VISITATION OF LITTLE COLORADO RIVER AND DEER CREEK (MAY – AUGUST)

	Alternatives							
	A	B	C	D	E	F	G	H
Days with 100+ Visitors								
Little Colorado River	28	0	1	11	0	0	0	0
Deer Creek	66	1	64	109	12	4	8	0
Days with 150+ Visitors								
Little Colorado River	11	0	0	0	0	0	0	0
Deer Creek	24	0	27	32	0	0	0	0

ALTERNATIVE A (CURRENT CONDITIONS)

Analysis

The most noticeable effect to cultural resources from recreational river use would be from continued visitation to sensitive archeological sites, historic properties, cultural landscapes, and traditional cultural properties. This visitation, while often well intentioned, has led to impacts to a number of sensitive sites along the mainstem and side canyons of the Colorado River.

Based on NPS and HDCR site records, a total of 674 prehistoric and historic archeological sites are known to be along the Colorado River from Glen Canyon Dam to Lake Mead, and in side canyons below Lees Ferry within approximately a 2-mile hiking distance from the river (Fairley et al. 1994; Jackson 1997; GRCA site files 2003). Side canyon sites farther than 2 miles are included if they are known to be visited by river runners based on conversations with Grand Canyon river guides, various publications, and park staff. Of the 674 sites, 487 are located along the mainstem of the Colorado River and 187 in side canyons.

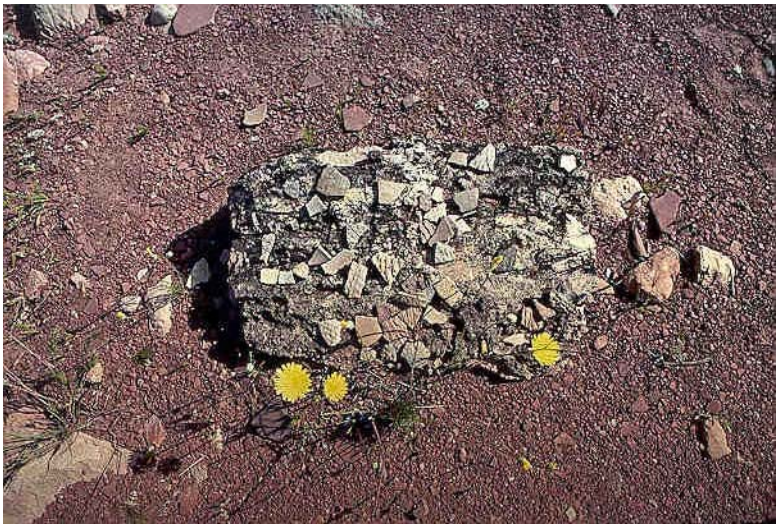
Archeological site monitoring of over 300 of these known visitor impacted properties since 1978 (Euler 1979) has identified some type of visitor impact to most of these sites, primarily related to social trailing, on-site camping, trash and artifact displacement. NPS and HDCR personnel have observed ongoing, direct visitor impacts to archeological and ethnographic resources accessible to river users in both the river corridor and side canyons (Balsom 1985; Euler and Gumerman 1978; Fairley et al. 1994; Jackson, Kennedy, and Phillips 2002; Leap et al. 2000; Neal and Gilpin 2000). Foot traffic and camping have created trails and areas of compaction that divert the natural flow of water and often become paths of severe erosion. Over time these trails can become gullies or arroyos that wash away character-defining elements of the cultural resources (Photo 4-9). In some cases visitors have climbed onto walls or over rubble and trod on fragile artifacts, inadvertently damaging sites. Visitors also impact sites by collecting artifacts and placing them in piles at various points in the site (Photo 4-10), and they are known to rearrange rocks in features (e.g., rebuild walls). Presumably these are well-intentioned efforts; however, artifact or rock displacement can destroy the integrity and research potential of these ancient sites, some of which have remained undisturbed for thousands of years. Much less common, but often more damaging, visitor impacts include intentional destruction of site integrity through theft, graffiti, excavation, and feature destruction.

While the majority of visitors are conscientious about protecting cultural resources, a small percentage of visitors ignore park regulations and engage in acts that are destructive to the resource. Given that, management variables such as group size, launches per day, and trip length can help influence cultural resource vulnerability by contributing to or decreasing the level of site accessibility and crowding at sites.

Under Alternative A the management of recreational use would continue to allow large group sizes, lengthy trips, and spikes in the number of trips and people at one time, and daily launches (see Table 4-1). User-days would remain capped at current levels, which would probably result in approximately the same number of total yearly passengers. Similarly, user discretionary time would remain similar to current levels.

PHOTO 4-9: EXAMPLE OF EROSION AT A SIDE CANYON SITE

PHOTO 4-10. DISPLACED PREHISTORIC POTTERY SHERDS COLLECTED AND LEFT BY VISITORS



Given the steady reduction in the number and size of beaches, the large group sizes under this alternative pose the greatest threat to resources in the old high-water zone, where visitors camp when they have been crowded off the beaches. The long trip lengths would increase the level of accessibility to all sites, but particularly those in the side canyons. Additionally, helicopter exchanges at Whitmore would be at their highest level under this alternative. These variables can directly and indirectly affect impacts to cultural sites along the river corridor and side canyons.

Group size, trip length, maximum allowable launches per day, trips and people at one time in the summer season are at their highest in this alternative, indicating a higher probability of crowding at certain attraction sites. Many of these variables regularly spike in the summer. During these spikes, up to nine groups can launch together, leading to congestion and crowding at attraction sites, some of which are cultural resource locations. User discretionary time, however, is relatively low, resulting in large groups of people arriving at the same places and having little time to actually experience the resource. Impacts from summer use result in a localized, adverse, long-term, minor to major effect to specific cultural resources.

Overall use levels under this alternative as measured by user-days, total passengers, and total user discretionary time in the winter and shoulder seasons would be at or near the lowest levels for all alternatives (see Table 4-2). While these variables indicate some of the lowest levels of off-season use, they coincide with the highest allowable group sizes and trip lengths. Impacts from winter and shoulder season use result in a localized, adverse, long-term, minor to moderate effect to specific cultural resources.

Traditional cultural properties and the biological resources of the canyon are a significant resource to many of the affiliated tribes. Natural quiet and the ability to hear songbirds were mentioned by some tribal elders as significant aspects of their assessment of the health of the canyon environment. Noise from aircraft and motorboats may affect the ability of certain traditional tribal practitioners to interact with park resources. Likewise, congestion, crowding, and inappropriate behavior at specific attraction sites that are also traditional cultural properties negatively impact these resources and the tribal values associated with them. For example, current management has high levels of use at two identified traditional cultural properties, namely the Little Colorado River confluence and Deer Creek. Table 4-26 indicates that from May to August, the Little Colorado River and Deer Creek experience 28 and 66 days, respectively, in which more than 100 people visited in a single day. The two sites experienced 11 and 24 days, respectively, in which more than 150 people visited in a single day. These numbers are at their highest for Alternative A of all the alternatives. Impacts from crowding and spikes in use result in localized, adverse, long-term, minor to moderate effects to cultural resources, particularly at traditional cultural properties and ethnobotanical locations.

Mitigation of Effects

Actions needed to mitigate adverse effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.), but because current management of the river corridor allows substantial spikes in use, as well as the longest allowable trip lengths and the largest allowable group sizes of any of the alternatives, it is unlikely that mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in

measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative A on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative A would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Effects under Alternative A to individual nonrenewable resources would be direct and measurable. Because the integrity of the resource might be jeopardized, thus affecting the eligibility of the property for the National Register of Historic Places, the intensity of impacts would be moderate to major, depending on accessibility and intensity of visitation from the river. Effects would be adverse, localized, and year-round, with most impacts occurring to readily accessible river corridor sites in the high-use summer months, and to side canyons sites primarily during the shoulder months. For the most part, these impacts would be long term to permanent. Due to substantial spikes in use and the longest allowable trip lengths and the largest allowable group sizes of any of the alternatives, it is unlikely that reasonable mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity. Alternative A would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative A, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative A would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE B

Analysis

Under Alternative B recreational motor trips would be prohibited and group sizes, maximum daily launches, and probable total yearly passengers would be the lowest of any of the alternatives (see Table 4-1). Yearly user discretionary time would increase to 576,754 hours from the current level of 355,081 hours. Implementation of a launch-based system would eliminate spikes in use.

Summer use under this alternative represents a decrease in total user-days (down to 107,418 from 121,869 currently) and total passengers (down to 8,492 from 18,128 currently). This, along with reductions in group size, trip length, number of trips and people at one time, as well as the elimination of Whitmore exchanges, would reduce crowding, thus decreasing the incidence of unintentional impacts at camping and attraction sites. Shorter trip lengths, which reduce the accessibility of side canyon sites would be somewhat offset by an increase in user discretionary time (from 294,506 hours currently to 431,444 hours), which could result in increased accessibility to all sites, particularly in side canyon. While user discretionary time could represent an increase in the number of sites per trip that river runners visit, it could also represent an increase in the amount of time that visitors spend at fewer sites. Overall, summer use would have a beneficial, localized, negligible to minor effect compared to current use.

Overall use levels in the winter and shoulder seasons under this alternative, as measured by user-days and total passengers, would increase above current levels, but would be at much lower levels than the rest of the alternatives. These levels of off-season use coincide with the lowest allowable group sizes and lower trip lengths. Compared to current use, these increases directly contribute to the accessibility and vulnerability of cultural resources and thus represent an adverse, localized, negligible to minor effect.

Eliminating helicopter and hiking exchanges at Whitmore under this alternative would reduce the probability of impacts that have been associated with sites below this point on the river.

Alternative B would have a beneficial effect on traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by reducing crowding, noise, and congestion. For example, visitation at the Little Colorado River under this alternative is not expected to exceed 100 people in a single day, and visitation at Deer Creek is only expected to have one day that would exceed 100 visitors. This significant decrease from current conditions represents the lowest level of daily visitation at these sites of all of the alternatives.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased education, monitoring, patrols, site stabilization, etc.), and would be needed primarily to mitigate new use in the winter and shoulder seasons. Use levels would generally be lower in the summer months, with the exception of user discretionary time. A monitoring and treatment plan to determine and mitigate impacts from visitation would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative B on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative B would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on the reduction of use compared to current conditions, Alternative B would directly contribute to the long-term protection and stabilization of individual cultural resource sites,

especially those in the mainstem. This would be a beneficial, localized, negligible to minor effect that is highly dependent on site accessibility and vulnerability. However, adverse effects from visitation to nonrenewable cultural resource sites would continue to be measurable and, at times, of severe consequence to individual resources. Thus, most of the effects from visitation would be direct, adverse, negligible to moderate, and irreversible. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, effects would be localized and highly dependent on accessibility. Effects would continue to occur year-round, with most impacts occurring during the summer when an increase in user discretionary time offers additional opportunities for visitors to access sensitive resources. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative B would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative B, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative B would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

ALTERNATIVE C

Analysis

Under Alternative C recreational motor trips would be prohibited. Group sizes and trip lengths would be at lower levels than current, but probable total user-days and user discretionary time would be the highest of any of the alternatives (see Table 4-1). The number of probable yearly passengers would increase from 22,461 (current) to 25,228. Implementing a launch-based system would eliminate spikes in use.

Summer use under this alternative represents a decrease in total user-days (down to 110,120 from 121,869 currently) and total passengers (down to 11,252 from 18,128 currently). This, along with moderate decreases in group size, trip length, and number of trips and people at one time, would help reduce crowding and the incidence of unintentional impacts at camping and attraction sites. These variables would be somewhat offset, however, by an increase in user discretionary time from 294,506 hours currently to 335,089 hours, which might result in increased accessibility to all sites, particularly side canyon sites. While user discretionary time could represent more sites per trip visited by river runners, it could also represent an increase the amount of time that visitors spent at fewer sites. Overall, summer use would have a beneficial, localized, negligible to minor effect compared to current use.

Under this alternative, overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would increase considerably above current levels (see Table 4-2) and in most cases would represent the highest use of all of the alternatives. Allowable trip lengths would be reduced from 21 to 18 days in the shoulder season and from 30 to 21 days in the winter. Compared to current use, these increases would directly contribute to the accessibility and vulnerability of cultural resources, thus representing an adverse, localized, minor to moderate, effect.

Helicopter exchanges, but not hiking exchanges, at Whitmore would be eliminated under this alternative. No data exist to differentiate impacts from the two exchange types.

Alternative C would have a beneficial effect on some traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by reducing crowding, noise, and congestion. For example, visitation at the Little Colorado River under this alternative is expected to have 1 day that would exceed 100 people in a single day, but visitation at Deer Creek is expected to have 64 days that would exceed 100 visitors. The Little Colorado River is not expected to have any days that exceed 150 visitors in a single day, but Deer Creek is expected to have 27. These are significant decreases from current condition for visitation at the Little Colorado River, but the change in use patterns for Deer Creek from current condition would be negligible.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.), but because of the considerable increases in winter and shoulder season use, as well as the highest yearly user-days and user discretionary time of any alternative, it is unlikely that the mitigations could be implemented at a level sufficient to reduce impacts to a minor intensity:

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative C on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative C would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current condition, Alternative C directly contributes to the long-term protection and stabilization of individual cultural resource sites by reducing some variables and indicators of crowding. This is offset, however, by an increase in user-days and user discretionary time in each season, but particularly by the overwhelming increase in these factors in the off-seasons. Overall, this alternative would have a direct, long-term, minor to moderate adverse effect as compared to current condition. Adverse effects from visitation to nonrenewable cultural resources would continue to be measurable, and at times impacts to individual resources would be moderate to major. Effects from Alternative C would be direct, adverse, and measurable to individual non-renewable resources. Because the integrity

of resources could be jeopardized, thus affecting national register eligibility of a property, the intensity of impacts would be moderate to major. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be localized and highly dependent on accessibility. Effects would occur year-round, with the majority of new impacts occurring in the winter and shoulder seasons. Because of the considerable increases in winter and shoulder season use, as well as the highest yearly user-days and user discretionary time of any of the alternatives, it is unlikely that mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity. Alternative C would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative C, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative C would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE D

Analysis

Under Alternative D recreational motor trips would be permitted from May to August and from December to February. Group sizes and trip lengths would be at lower levels than under current conditions, but user discretionary time would be among the highest of any of the alternatives (see Table 4-1). The number of probable yearly passengers would decrease from 22,461 currently to 20,427, and probable total user-days would increase from 171,131 currently to 223,314. Implementing a launch-based system would eliminate spikes in use.

Summer use under this alternative would represent a small increase in total user-days (122,739) from 121,869 currently, and a large increase in total user discretionary time to 461,641 hours from 294,506 currently; however, total projected passengers would decrease from 18,128 currently to 13,765. These numbers indicate that fewer people would have more time to interact with the environment, which might result in increased accessibility to all sites, particularly to side canyon sites. However, reductions in group size, trip length, and the number of trips and people at one time would help reduce crowding and the incidence of unintentional impacts at campsites and attractions. Overall, summer use would have an adverse, localized, negligible to minor effect compared to current use.

Under this alternative overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would increase considerably above current levels (see Table 4-2). Overall, allowable trip lengths would be reduced from current, with the exception of noncommercial 30-day oar trips, which would remain the same. Compared to present conditions, this increase in use would directly contribute to the accessibility and vulnerability of cultural resources, resulting in an adverse, localized, minor to moderate effect.

Helicopter exchanges at Whitmore would be eliminated under this alternative, but not hiking exchanges. No data have been collected to differentiate impacts from the two exchange types.

Alternative D would have a varied effect on some traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon

environment by reducing the months when boat and helicopter motors could be heard and by reducing some aspects of crowding. For example, visitation at the Little Colorado River under this alternative is expected to have 11 days that would exceed 100 people in a single day, but visitation at Deer Creek is expected to have 109 days that would exceed 100 visitors. The Little Colorado River is not expected to have any days that would exceed 150 visitors in a single day, but Deer Creek is expected to have 32. These would be moderate decreases from current conditions for visitation at the Little Colorado River, but the increase in daily visitor use patterns for Deer Creek from current condition would be considerable. This increase would result in an adverse, short-term, minor effect on localized resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.), but because of the considerable increases in winter and shoulder season use, as well as remarkably high user discretionary time, it is unlikely that mitigations could be implemented at a level sufficient to reduce impacts to a minor intensity:

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative D on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative D would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current conditions, Alternative D would directly contribute to the long-term protection and stabilization of individual cultural resource sites by reducing some variables and indicators of crowding. This would be offset, however, by a substantial increase in user discretionary time in each season and an increase in user-days in the off-season. Overall, this alternative would have an adverse, long-term, minor to moderate effect on cultural resources, as compared to current conditions. Adverse effects from visitation to non-renewable cultural resources would continue to be measurable, and at times impacts to individual resources would be moderate to major. Effects from Alternative D would be direct, adverse, and measurable to individual nonrenewable resources. Because the integrity of the resource might be jeopardized, thus affecting a property's national register eligibility, the intensity of impacts would be moderate to major. However, because not all cultural resources along the river corridor would be readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be

localized and highly dependent on accessibility. Effects would occur year-round, with the majority of new impacts occurring in the winter and shoulder seasons. Because of the considerable increases in winter and shoulder season use, as well as remarkably high user discretionary time, it is unlikely that that mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity. Alternative D would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative D, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative D would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE E

Analysis

Under Alternative E recreational motor trips would be permitted April through September. Group sizes and trip lengths would be at lower levels than now, but user discretionary time would be among the highest of any alternative (see Table 4-1). The number of probable yearly passengers would increase from 22,461 currently to 23,812, and probable total user-days from 171,131 currently to 237,183. Implementing a launch-based system would eliminate spikes in use.

Summer use under this alternative would decrease negligibly in total user-days (down to 121,836 from 121,869 now), and total user discretionary time would increase to 373,761 hours from 294,506 hours now, but total projected passengers would decrease to 15,230 from 18,128 now. These numbers indicate that fewer numbers of people would have more time to interact with the environment, which could result in increased accessibility to all sites, particularly to side canyon sites. However, reductions in group size, trip length, and the number of trips and people at one time would help reduce crowding and unintentional impacts at camping and attraction sites. Overall, summer use would have an adverse, localized, negligible to minor effect compared to current conditions.

Under this alternative, overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would increase considerably compared to current levels (see Table 4-2), but would be relatively low compared to rest of the alternatives. Allowable trip lengths would be among lowest of all alternatives. Compared to current use, the increase in use would directly contribute to the accessibility and vulnerability of cultural resources, resulting in an adverse, localized, minor to moderate effect.

Helicopter exchanges at Whitmore would be restricted to the months from April to September, while hiking exchanges would be permitted all year. No data have been collected to differentiate impacts between the two exchange types.

Implementing Alternative E would have a beneficial effect on traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by substantially reducing when boat and helicopter motors could be heard and by reducing crowding and congestion at key attractions. For example, visitation at the Little Colorado River under this alternative is not expected to exceed 100 people in a single day, and

visitation at Deer Creek is only expected to have 12 days that would exceed 100 visitors. Neither site is expected to have more than 150 visitors in a single day. This level of visitation represents a substantial decrease from current conditions. This increase would result in a beneficial, short-term, minor effect on localized resources, compared to current conditions.

Mitigation of Effects

Actions to mitigate effects would include all of those discussed above on page 545 (increased education, monitoring, patrols, site stabilization, etc.), and would be needed primarily to mitigate new use in the winter and shoulder seasons. A monitoring and treatment plan to determine and mitigate impacts from visitation would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative E on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative E would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current conditions, Alternative E would directly contribute to the long-term protection and stabilization of individual cultural resource sites by reducing crowding, especially in the summer. This would be somewhat offset, however, by an increase in user discretionary time in every season and an increase in user-days in the winter and shoulder seasons. Overall, this alternative would have a direct, long-term, negligible to minor adverse effect as compared to current conditions. Adverse effects from visitation to nonrenewable cultural resources would continue to be measurable, and at times impacts to individual resources would be moderate to major. Effects under Alternative E to individual nonrenewable resources would be direct and adverse. Because the integrity of the resource could be jeopardized, thus affecting its national register eligibility, the intensity of impacts would be minor to moderate. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be localized and highly dependent on accessibility. Effects would occur year-round, with the majority of new impacts in the winter and shoulder seasons. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative E would not result in the impairment of

cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative E on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative E would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE F

Analysis

Under Alternative F recreational motor trips would be permitted January through June. Group sizes and trip lengths would be at lower levels than now. User discretionary time would be higher than current conditions, but relatively low compared to other alternatives (see Table 4-1). Probable yearly passengers would increase from 22,461 currently to 25,415, and probable total user-days would increase from 171,131 currently to 235,146. Implementing a launch-based system would eliminate spikes in use.

Summer use under this alternative would decline considerably in total user-days, down to 102,291 from 121,869 currently; total user discretionary time would decrease to 269,507 hours from 294,506 currently; and total projected passengers would fall to 13,954 from 18,128 now. These numbers indicate an overall decrease in use. Additionally, reductions in group size, trip length, and the number of trips and people at one time would help reduce crowding and unintentional impacts at camping and attraction sites. Overall, decreased summer use would have a beneficial, localized, negligible to minor effect compared to current conditions.

Under this alternative, overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would increase considerably above current levels (see Table 4-2). Additionally, allowable trip lengths would be reduced. Compared to current use, this increase in use would directly contribute to the accessibility and vulnerability of cultural resources, resulting in an adverse, localized, minor to moderate effect.

Helicopter exchanges at Whitmore would be restricted to the months from January to June, while hiking exchanges would be permitted all year. No data have been collected to differentiate impacts from the two exchange types.

Alternative F would have a beneficial effect on traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by substantially reducing when boat and helicopter motors could be heard and by reducing crowding and congestion at key attractions. For example, visitation at the Little Colorado River under this alternative is not expected to exceed 100 people in a single day, and visitation at Deer Creek is only expected to have four days that would exceed 100 visitors. Neither site is expected to have more than 150 visitors in a single day. This level of visitation represents a substantial decrease from current conditions. This increase would result in a beneficial, short-term, minor to moderate effect on localized resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate adverse effects would include all of those discussed on page 545 (increased education, monitoring, patrols, site stabilization, etc.), and would be needed mitigate impacts from new use in the winter and shoulder seasons. A monitoring and treatment plan to determine and mitigate impacts from visitation would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative F on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative F would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current conditions, Alternative F would directly contribute to the long-term protection and stabilization of individual cultural resource sites by reducing crowding, especially in the summer. This would be somewhat offset, however, by an increase in user discretionary time, total projected passengers, and user-days in the winter and shoulder seasons. Overall, this alternative would have an adverse, long-term, negligible to minor effect as compared to current conditions. Adverse effects from visitation to nonrenewable cultural resources would continue to be measurable, and at times impacts to individual resources could be moderate to major. Effects from Alternative F would be direct, adverse, and measurable to individual nonrenewable resources. Because the integrity of the resource might be jeopardized, thus affecting its national register eligibility, the intensity of impacts would be minor to moderate. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be localized and highly dependent on accessibility. Effects would occur year-round with the majority of new impacts occurring in the winter and shoulder seasons. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative F would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative F on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative F would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE G

Analysis

Under Alternative G recreational motor trips would be permitted January through August. Group sizes would be somewhat lower than current, but would be higher than any of the other alternatives. Trip lengths would generally be at the lowest levels of all of the alternatives, with the exception of noncommercial winter oar trips, which would still be reduced to 21 from 30 currently. Yearly user discretionary time is higher than current condition, but is at the lowest levels of all the other alternatives (see Table 4-1). The number of probable yearly passengers would increase from 22,461 now to 28,680, and probable total user-days would increase from 171,131 currently to 249,910. Implementing a launch-based system would eliminate spikes in use.

Summer use under this alternative would decrease considerably. Total user-days would decline to 101,984 from 121,869 currently; total user discretionary time would decrease to 229,958 hours from 294,506 hours currently (the lowest of any alternative); and total projected passengers would fall to 14,939 from 18,128 currently. As a result, visitors would have less time to interact with the environment. This would be offset, however, by the large group size (40) for commercial motor trips. Because these large groups do not have sufficient time to access side canyon sites, it is anticipated that the impacts would generally be restricted to the most easily accessible sites along the river. Overall, summer use would have a beneficial, localized, negligible to minor effect compared to current conditions.

Overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would increase considerably above current levels and would be among the highest of all of the alternatives(see Table 4-2). Additionally, twice as many winter launches would be allowed as now, and shoulder season launches, while reduced from current levels, would be higher than any other alternative. However, reductions in trip lengths would result in relatively low user discretionary time, particularly in the shoulder seasons. While trip lengths would reduced in the off-seasons, less daylight would likely restrict access to side canyon sites, so impacts would likely be most prevalent at the most easily accessible sites along the river. Compared to current use, these factors indicate that the effect to cultural resources would be adverse, highly localized, and negligible to minor.

Helicopter exchanges at Whitmore would be restricted to the months from January to August, while hiking exchanges would be permitted all year. No data have been collected to differentiate impacts between the two exchange types.

Implementing Alternative G would have a beneficial effect on traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by reducing the months when boat and helicopter motors could be heard and by reducing crowding and congestion at key attraction sites. For example, visitation at the Little Colorado River under this alternative is not expected to exceed 100 people in a single day, and visitation at Deer Creek is only expected to have 8 days that would exceed 100 visitors. Neither site is expected to have more than 150 visitors in a single day. This level of visitation represents a substantial decrease from current conditions. This increase would represent a

beneficial, short-term, minor to moderate effect on localized resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased education, monitoring, patrols, site stabilization, etc.), and would be needed mitigate impacts from new use in the winter and shoulder seasons. Because trip lengths are substantially reduced, adverse effects from visitation by large groups would be generally restricted to easily accessible river corridor sites. Site hardening at major attraction sites would decrease the probability of effect reaching the major threshold. A monitoring and treatment plan to determine and mitigate impacts from visitation would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative G on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative G would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current condition, Alternative G would directly contribute to the long-term protection and stabilization of individual cultural resource sites by reducing passengers and trip lengths in the summer season. This would be somewhat offset, however, by relatively large group sizes and increased off-season use, as represented by total projected passengers and user-days. Overall, this alternative would have an adverse, long-term, and negligible to minor effect as compared to current conditions. Adverse effects from visitation to nonrenewable cultural resources would continue to be measurable, and at times impacts to individual resources would be moderate to major. Alternative G would have direct, adverse, and measurable impacts to individual nonrenewable resources. Because the integrity of these resources might be jeopardized, thus affecting their national register eligibility, the intensity of impacts would be minor to major. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be localized and highly dependent on accessibility. Effects would occur year-round, with the majority of new impacts occurring in the winter and shoulder seasons. Impacts to cultural

resources could be reduced to a minor intensity with reasonable mitigation. Alternative G would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative G on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative G would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

ALTERNATIVE H (NPS PREFERRED ALTERNATIVE)

Analysis

Under Alternative H recreational motor trips would be permitted March through August. Group sizes would be lower than current in the summer and considerably lower in the shoulder seasons. Trip lengths would be lower than now, with some opportunities for longer trips in the winter. Yearly user discretionary time would be higher than it is currently, but lower than several other alternatives (see Table 4-1). Probable yearly passengers would increase from 22,461 now to 26,317, and probable total user-days would increase from 171,131 to 218,225 under Alternative H. Implementing a launch-based system would eliminate spikes in use.

This alternative would have the highest level of summer user-days (125,243) and total projected passengers (18,132) compared to current levels (121,869 user-days and 18,128 total passengers) and also compared to all other alternatives. Summer user discretionary time would be relatively high at 402,037 hours compared to 294,506 hours now. An overall increase in summer use would be offset, however, by reductions in group size, trip length, and numbers of trips and people at one time, which would help reduce crowding and unintentional impacts at camping and attractions. Overall, summer use would have an adverse, localized, minor effect compared to current use.

Overall use levels in the winter and shoulder seasons, as measured by user-days and total passengers, would be greater than current levels, but they would be among the lowest of all of the alternatives (see Table 4-2). Group sizes in the off-seasons would be at the lowest level of all of the alternatives, with shoulder commercial trips reduced to 24 passengers and guides per day. Trip lengths would be increased somewhat in the off-seasons, but with decreased available daylight it is anticipated that accessibility to side canyon sites would be restricted and that impacts would be generally confined to sites most easily accessible along the river. Compared to current use, these factors indicate that the effect to cultural resources would be adverse, highly localized, and negligible to minor.

Helicopter exchanges at Whitmore would be restricted to the months from May to August, and hiking exchanges would only permitted in March, April, September, and October. While the decrease in exchanges suggests a potential for reduced adverse effects to cultural resources, no data have been collected to differentiate impacts between the two exchange types.

Alternative H would have a beneficial effect on traditional cultural properties, ethnobotanical resources, and other significant aspects of tribal assessments of the health of the canyon environment by substantially reducing the months when boat and helicopter motors could be heard and by reducing crowding and congestion at key attractions. For example, visitation at the

Little Colorado River and Deer Creek is not expected to ever exceed 100 visitors in a day. This level of visitation would represent a substantial decrease from current condition and the lowest level of daily visitation at these sites of all of the alternatives. This increase would result in a beneficial, short-term, moderate effect on localized resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased education, monitoring, patrols, site stabilization, etc.), which would be needed to mitigate impacts from new use in the winter and shoulder seasons. A monitoring and treatment plan to determine and mitigate impacts from visitation would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), results in measurable changes to localized cultural resources. This effect results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative H on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative H would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on the projected changes in use patterns from current conditions, Alternative H would directly contribute to the long-term protection and stabilization of individual cultural resource sites by factors such as reductions in group size, trip length, and numbers of trips and people at one time, even though overall summer use would increase. This would be offset somewhat, however, by increases in summer user discretionary time and off-season use, as represented by total projected passengers and user-days. Off-season user discretionary time, however, would be relatively low as compared to Alternative A, and small group sizes would help mitigate the effects of increased use. Overall, this alternative would have an adverse, long-term, negligible to minor effect as compared to current conditions. Adverse effects from visitation to nonrenewable cultural resources would continue to be measurable, and at times impacts to individual resources would be moderate to major. Effects to individual nonrenewable resources would be direct, adverse, and measurable. Because the integrity of the resource might be jeopardized, thus affecting its national register eligibility, the intensity of impacts would be minor to moderate. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources in Zone 1. Therefore, these long-term to permanent effects would be localized and highly dependent on

accessibility. Effects would occur year-round, with the majority of new impacts occurring in the winter and shoulder seasons. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative H would not result in the impairment of cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative H on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative H would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

IMPACT ANALYSIS — LOWER GORGE ALTERNATIVES

Key variables, indicators, and use estimates (Table 4-3 for the Lower Gorge alternatives) were used to determine changes in use at specific resource sites and projected seasonal changes in use patterns, respectively.

ALTERNATIVE 1 (CURRENT CONDITIONS)

Analysis

Direct and indirect impacts to cultural resources would be essentially the same as those identified under Alternative A for the Lees Ferry to Diamond Creek portion of the Colorado River. These impacts consist primarily of trailing and trampling, on-site camping, collection piles, and physical erosion related to trailing and camping. The intensity of the impacts would vary, however, since the Lower Gorge is a different use zone in which the types and levels of use vary dramatically from the upper portion of the corridor. Specifically, 16 mainstem historic properties, 53 side canyon sites, and 22 traditional cultural properties have been documented within the Lower Gorge (Glassco 2003b; NPS 2003j), and their current conditions are included in the data already discussed. The Lower Gorge is unique, however, in that 108 miles of the Colorado River, including the area known as the Lower Gorge, lies adjacent to Hualapai tribal lands. This land status has resulted in overlapping management of cultural resources by the National Park Service and the Hualapai Tribe. There are only six traditional cultural properties in this section that are regularly monitored for impacts by Hualapai Division of Cultural Resources, and they are all located at heavily visited areas — Diamond Creek, Bridge Canyon, Spencer Canyon, Travertine Canyon, Travertine Falls, and Burnt Springs (Jackson, Kennedy, and Phillips 2002; Glassco 2003a). These areas are specific to Hualapai tribal lands, but access to these locations is through Grand Canyon National Park.

Existing operations and current management practices have generally resulted in a range of impacts to cultural resources from minor to major, depending primarily on a resource's location in relation to the river corridor, intensity and duration of visitation, time of year, and level of sedimentation. If left unmitigated, all of the human-caused impacts would result in an adverse effect to the resource. Without mitigation these cultural resource impacts would remain measurable. Impacts to cultural resources would tend to be long term or permanent, localized, and highly dependent on accessibility from the river. Impacts at sites that receive intense and frequent visitation, such as at Diamond Creek (for both launches and takeouts), Spencer Canyon, Burnt Spring Canyon, Travertine Canyon, Travertine Falls, and the Quartermaster area, include

permanent undesignated trails, trash, vegetation clearing to create camping spots, trampling of culturally significant plants, and/or physical erosion related in part to trailing and camping (Phillips and Jackson 1997; Jackson, Kennedy, and Phillips 2001, 2002). Each of these sites has been identified as a traditional cultural place by the Hualapai Tribe. Since there are fewer attractions and accessible canyons below Diamond Creek, some of which are dependent on the water levels of Lake Mead, the same sites and canyons tend to get visited by most groups traveling downriver.

Effects to cultural resources, primarily traditional cultural properties, can occur through the introduction of audible or visual intrusions that affect the integrity of the resource. Aircraft, motorboats, pontoon excursions, and increased congestion and crowding can negatively affect properties eligible for the National Register of Historic Places. However, the majority of the impacts occur either on or over Hualapai tribal lands and require an evaluation by the tribal historic preservation officer. Thus far, no effects from these operations have been identified by any affiliated tribe.

Depending on the surface elevation of Lake Mead, upriver recreational boating from Lake Mead can vary. This use would not be regulated under this alternative (although personal watercraft or jet skis are prohibited). The amount of use varies in response to lake levels, independent of the management alternatives, and statistics on these varying use levels is not available. Consequently, effects from noncommercial upriver trips are not included in this analysis.

Upriver commercial jetboat traffic is a specific concern for the Hualapai Tribe. The Hualapai resource staff have indicated that jetboats create wakes that exacerbate beach erosion, thereby threatening archeological and ethnobotanical sites. While this may be a valid concern at specific resource sites, the Lower Gorge for the most part is a depositional environment. Thus effects are generally limited to recently deposited and newly exposed silt banks.

Under current management, HRR day trips generally launch one large trip per day from Diamond Creek, and passengers exit the river by helicopter in the Quartermaster area. According to the 2001 use moratorium, these trips can carry 80 passengers and 20 guides. While smaller trips are the norm, larger trips have been reported by Grand Canyon Resort Corporation employees and park river rangers. The greatest effect to cultural resources from HRR trips is from the impacts caused by large groups. These impacts, however, are generally restricted to Diamond Creek, Quartermaster, and lunch and attraction sites such as Travertine Canyon and Falls and Spencer Canyon. The resulting trash, physical erosion, trampling of culturally significant plants, and undesignated trails have had adverse, short- to long-term, localized, minor to moderate impacts on cultural resources.

HRR overnight trips generally occur once a week and carry 34 passengers, including crew. They generally spend only one or two nights in the Lower Gorge before taking out, via helicopter, at Quartermaster (RM 262). HRR trips camp in one of 15 naturally occurring campsites in the Lower Gorge. No modifications, including installment of temporary facilities, are made to campsites in this area. HRR trips, which are under the supervision of Hualapai tribal members employed by HRR, generally have a set itinerary, and visitors have little time to interact with the environment. Because these trips are short and infrequent, effects to cultural resources are adverse, long term, highly localized, and negligible to minor.

Noncommercial trips that launch from Diamond Creek have no time limit on their trip. Thus, access to cultural resources in the Lower Gorge is relatively unlimited. Of particular concern is the access provided to side canyon archeological sites and traditional cultural properties. Group sizes are relatively small, however, which decreases the likelihood of crowding and its associated effects at attraction and campsites. Overall, noncommercial use has a direct, adverse, long-term, minor to moderate effect on localized resources.

Physical impacts on cultural resources from pontoon use would continue to be limited to the impacts at the launch / takeout area at Quartermaster (RM 262), where a traditional cultural property is located. Pontoon operations during peak seasons average 188 passengers per day, although daily spikes above 500 passengers have been documented. During the non-peak season (October to March) operators average 160 passengers per day. The pontoon tours generally last 30 minutes, with access and egress at the same location in the Quartermaster area. Passengers on pontoon trips rarely have time for exploration, even in the direct vicinity of the helicopter pad and launch area. While archeological sites do exist in the vicinity of the visitor facilities in the Quartermaster area, they are relatively inaccessible due to the overgrowth of vegetation, and they have not been monitored for at least 10 years. Pontoon use has a direct, adverse, long-term, negligible to minor effect on localized resources.

Upriver traffic under this alternative is largely unlimited, with upriver commercial traffic levels tied to peaks in downriver traffic. Wakes from upriver travel are known to erode beaches and banks, most of which are newly deposited or exposed. Effects to archeological sites and historic properties would be negligible, given that these resources are generally located well above the areas that are being eroded. However impacts to ethnobotanical sites and traditional cultural properties could include damage to plants and access restrictions for tribal members, thus effects would be direct, adverse, highly localized, long term, and negligible to minor.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.). However, because current management of the river corridor allows for unregulated use, as well as the longest allowable trip lengths and group sizes of any of the alternatives, it is unlikely that that mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity:

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), and the effects of lowering Lake Mead levels, result in measurable changes to localized cultural resources. This results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative 1 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to

major. Alternative 1 would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

Conclusion

Under Alternative 1 effects to individual nonrenewable resources, particularly traditional cultural properties, would be direct and measurable. Because the integrity of the resource might be jeopardized, thus affecting its national register eligibility, the intensity of impacts would be minor to major, depending on accessibility from the river. Effects would be adverse, localized, and year-round, with most impacts occurring to the limited number of traditional cultural properties used by Grand Canyon Resort Corporation and its contractors and to side canyon sites accessed by recreationists on noncommercial trips. For the most part, these impacts would be long term to permanent. Because current management of the river corridor allows for unregulated use, as well as the longest allowable trip lengths and group sizes of any of the alternatives, it is unlikely that mitigations would be implemented at a level sufficient to reduce impacts to a minor intensity. Alternative 1 would not result in the impairment of cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative 1 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 1 would result in a localized, adverse, long-term, minor to moderate contribution to these cumulative effects.

ALTERNATIVE 2

Analysis

Under Alternative 2 group sizes, total number of daily passengers, and allowable upriver travel would be at the lowest levels of all of the alternatives (see Table 4-3). Additionally, pontoon use and all associated operations and facilities, would be eliminated.

During the peak season HRR would be allowed to launch two trips per day, each with up to 30 passengers, including guides; During the non-peak season one trip per day of 30 people would be allowed. Because the greatest current effect to cultural resources from HRR trips is the impacts caused by large groups, this alternative would have a direct, beneficial, long-term, negligible to moderate effect compared to current condition at localized sites, particularly at Diamond Creek, Quartermaster, and lunch and attraction sites such as Travertine Canyon and Falls and Spencer Canyon.

HRR overnight trips could launch one trip per day, year-round, with 30 passengers, including crew. It is unknown whether demand would eventually increase for this type of trip. Current trips are infrequent, but group size, trip length, and number of launches is unregulated. Thus, this alternative would provide for greater protection of cultural resources in the event that demand continued to grow. Overall, HRR overnight use would have a direct, beneficial, long-term, negligible to minor effect on cultural resources, compared to current conditions.

The number of noncommercial trips allowed to launch from Diamond Creek would remain unchanged, but trip length would be limited to four nights in the peak season and five nights in

the non-peak season. This decrease in allowable trip length would limit access to sensitive archeological sites and traditional cultural properties in side canyons. Group sizes would remain relatively small, decreasing the likelihood of crowding and its associated effects at attractions and campsites. Compared to current conditions, noncommercial use would have a direct, beneficial, long-term, minor to moderate effect on localized resources.

Because the current direct effect on cultural resources from pontoon use is negligible to minor, eliminating pontoon operations would result in a beneficial, long-term, negligible effect.

Upriver traffic under this alternative would be limited to two trips per day below RM 262. This reduction in allowable use would result in a beneficial, long-term, negligible to minor effect on cultural resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.). While use levels would be relatively low under this alternative, a monitoring and treatment plan to determine and mitigate impacts from visitation, especially in high-use sites, would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), and the effects of lowering Lake Mead levels, result in measurable changes to localized cultural resources. This results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative 2 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 2 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on group sizes, trip lengths, and daily passenger limits for trips launching at Diamond Creek, Alternative 2 would directly contribute to the long-term protection and stabilization of individual cultural resource sites compared to current conditions, especially sites located in side canyons and sites frequented by HRR trips. This would be a beneficial, localized, minor to moderate effect that would be highly dependent on site accessibility and vulnerability. However, adverse effects from visitation to nonrenewable cultural resources would continue to be measurable and, at times, of moderate to major intensity to individual resources. Thus, most of the effects from visitation would be direct, adverse, negligible to moderate, and irreversible.

However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources. Therefore, effects would be localized and highly dependent on accessibility. Effects would continue to occur year-round, with most impacts during summer when increased daylight allows more time for visitors to access sensitive resources. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative 2 would not result in the impairment of the cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative 2 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 2 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

ALTERNATIVE 3

Analysis

Under Alternative 3 group sizes and trip lengths would be at substantially lower levels than now. The total number of pontoon passengers, HRR passengers, and upriver trips would be near or above current levels(see Table 4-3).

Alternative 3 would allow three daily launches for HRR day trips during the peak season, each with up to 30 people, including guides. Two trips per day of 30 people would be allowed during the non-peak season. Summer passenger totals would be comparable to current conditions, although smaller group sizes would substantially reduce potential impacts from crowding. Winter use would allow for fewer passengers per day, in addition to restricting group size. Overall, this alternative would result in direct, beneficial, long-term, negligible to minor effects at localized sites, particularly at Diamond Creek, Quartermaster, and lunch and attraction sites such as Travertine Canyon and Falls and Spencer Canyon.

HRR could launch two overnight trips per day with a maximum of 30 people (including crew) all year. It is unknown whether demand would eventually increase for this type of trip. Current trips are infrequent, but group sizes, trip lengths, and numbers of launches are unregulated. Thus, this alternative would provide greater protection of cultural resources if demand continued to grow for this type of experience. Overall, HRR overnight use would have a direct, beneficial, long-term, negligible to minor effect on cultural resources, compared to current condition.

The number of noncommercial trips allowed to launch from Diamond Creek would remain unchanged, but trip lengths would be limited to five nights in the peak season and eight nights in the non-peak season. This decrease in allowable trip length would limit access to sensitive side canyon archeological sites and traditional cultural properties. Group sizes would remain relatively small, which would decrease the likelihood of crowding and its associated effects at attractions and campsites. Compared to current conditions, noncommercial use would have a direct long-term, minor beneficial effect on localized resources.

Physical effects from pontoon use on cultural resources would continue to be limited to the impacts at the launch / takeout area at the Quartermaster traditional cultural property (RM 262). Pontoon operations during the peak season would be limited to 400 passengers per day. While this level of use would be higher than the current average, it would be lower than the current

spikes in use. Passengers on pontoon trips rarely have time for exploration, even in the direct vicinity of the helicopter pad and launch area. While archeological sites do exist in the vicinity of the Quartermaster visitor facilities, these sites are relatively inaccessible due to the overgrowth of vegetation, but they have not been monitored for at least 10 years. Compared to current conditions, pontoon use would have a direct, adverse, long-term, negligible effect on localized physical resources at Quartermaster.

Upriver traffic under this alternative would be limited to six trips per day below RM 240 (Separation Canyon), which would be an adverse, long-term, negligible effect to cultural resources compared to current condition.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc. A monitoring and treatment plan to determine and mitigate impacts from visitation, especially in high-use sites, would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), and the effects of lowering Lake Mead levels, result in measurable changes to localized cultural resources. This results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative 3 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 3 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on group sizes, trip lengths, and daily passenger limits for trips launching at Diamond Creek, Alternative 3 would directly contribute to the long-term protection and stabilization of individual cultural resource sites, especially sites in side canyon and sites frequented by HRR trips. This would result in beneficial, localized, negligible to minor effects that would be highly dependent on site accessibility and vulnerability. However, adverse effects from visitation to nonrenewable cultural resources would continue to be measurable and, at times, of moderate to major intensity to individual resources. Thus, most of the effects from visitation would be direct, adverse, negligible to moderate, and irreversible. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources. Therefore, effects would be localized and highly dependent on accessibility. Effects would continue to occur year-round, with most impacts during summer

when more available daylight allows additional opportunities for visitors to access sensitive resources. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative 3 would not result in the impairment of cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative 3 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 3 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

ALTERNATIVE 4 (NPS PREFERRED ALTERNATIVE)

Analysis

Alternative 4 is characterized by a redistribution of HRR operations and represents a consensus between the National Park Service and the Hualapai Tribe on levels of HRR use and other uses originating at Diamond Creek. This alternative, however, represents lower levels of pontoon boat use than the current average, which is preferred by Grand Canyon National Park managers. Under this alternative, HRR group sizes and trip lengths would be at substantially lower levels than now, and upriver trips would be below current levels (see Table 4-3).

Daily passenger totals during the peak season would be limited to 96, with group sizes (including guides) not to exceed 40. No limits would be placed on trips per day in the peak season. This alternative would offer HRR managers increased flexibility in scheduling launches, while encouraging the booking of smaller trips. Two trips of 20 people would be allowed during the non-peak season. Summer passenger totals would be somewhat higher than now, but smaller group sizes would reduce potential impacts from crowding. Winter use would allow for fewer passengers per day, as well as restricted group sizes. Compared to current conditions, this alternative overall would result in a direct, beneficial, long-term, minor effect at localized sites, particularly at Diamond Creek, Quartermaster, and lunch and attraction sites such as Travertine Canyon and Falls and Spencer Canyon.

For HRR overnight use three trips per day of 20 people each (including guides) could launch in the peak season and one trip per day in the non-peak season. It is unknown whether demand would eventually increase for this type of trip. Compared to current conditions where trips are infrequent, but group sizes, trip lengths, and number of launches are unregulated, this alternative would provide greater protection of cultural resources if demand for this type of experience continued to grow. Overall, HRR overnight use would have a direct, beneficial, long-term, negligible to minor effect on cultural resources compared to current conditions.

The number of noncommercial trips allowed to launch from Diamond Creek would remain unchanged, but trip length would be limited to three nights in the peak season and five nights in the non-peak season. This decrease in allowable trip lengths would limit access to sensitive side canyon archeological sites and traditional cultural properties. Group sizes would remain relatively small, decreasing the likelihood of crowding and its associated effects at attractions and campsites. Compared to current conditions, noncommercial use would have direct, beneficial, long-term, minor to moderate effects on localized resources.

Physical effects of pontoon use on cultural resources would continue to be limited to the impacts at the launch / takeout area at the Quartermaster traditional cultural property (RM 262). Pontoon operations during the peak summer season would be limited to 150 passengers per day, which would be lower than the current average and substantially lower than the current spikes in use. Passengers on pontoon trips rarely have time for exploration, even in the direct vicinity of the helicopter pad and launch area. While archeological sites do exist in the vicinity of the Quartermaster visitor facilities, these sites are relatively inaccessible due to the overgrowth of vegetation, but they have not been monitored for at least 10 years. Compared to current conditions, pontoon use would have direct, adverse, long-term, negligible effects on localized physical resources at Quartermaster.

Five upriver trips per day in the peak season are estimated under this alternative, and two trips per day in the non-peak season. This use would be restricted to the section of river below RM 260 unless Lake Mead was at full pool, then use would be allowed to RM 240 (Separation Canyon). This use would result in an adverse, long-term, negligible to minor effect on cultural resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.). While reductions in group size and trip length would reduce adverse effects compared to current conditions, a monitoring and treatment plan to determine and mitigate impacts from visitation, especially at high-use sites, would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), and the effects of lowering Lake Mead levels, result in measurable changes to localized cultural resources. This results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative 4 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 4 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on group sizes, trip lengths, and daily passenger limits for trips launching at Diamond Creek, Alternative 4 would directly contribute to the long-term protection and stabilization of individual cultural resource sites, especially in side canyon and sites frequented by HRR trips.

This would result in a beneficial, localized, negligible to minor effect that would be highly dependent on site accessibility and vulnerability. However, adverse effects from visitation to nonrenewable cultural resources would continue to be measurable and, at times, of moderate to major intensity to individual resources. Thus, most of the effects from visitation would be direct, adverse, negligible to moderate, and irreversible. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources. Therefore, effects would be localized and highly dependent on accessibility. Effects would continue to occur year-round, with most impacts during summer when more daylight allows additional opportunities for visitors to access sensitive resources. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative 4 would not result in the impairment of cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative 4 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 4 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

ALTERNATIVE 5 (HUALAPAI TRIBE PROPOSED ACTION)

Analysis

Alternative 5 is characterized by a redistribution of HRR operations and represents a consensus between the National Park Service and the Hualapai Tribe on levels of HRR use and other uses originating at Diamond Creek. This alternative, however, incorporates the Hualapai Tribe's proposed higher levels of pontoon boat use compared to current conditions. Under this alternative HRR group sizes and trip lengths would be at substantially lower levels than currently and upriver trips would be below current levels (see Table 4-3).

Daily passenger totals during the peak season would be limited to 96, with group sizes (including guides) not to exceed 40. No limits would be placed on trips per day in the peak season, allowing HRR managers increased flexibility in scheduling launches, while encouraging booking of smaller trips. Summer passenger totals are somewhat higher than current conditions, but smaller group sizes would reduce potential impacts from crowding. Two trips of 20 people would be allowed during the non-peak season. Winter use would allows for fewer passengers per day in addition to restricted group sizes. Compared to current conditions, this alternative overall would result in direct, beneficial, long-term, minor effects at localized sites, particularly at Diamond Creek, Quartermaster, and lunch and attraction sites such as Travertine Canyon and Falls and Spencer Canyon.

For HRR overnight trips, three trips per day could launch in the peak season and one trip per day in the non-peak season, with a maximum of 20 passengers per trip, including crew. It is unknown whether demand would eventually increase for this type of trip. Current trips are infrequent, but group sizes, trip lengths, and number of launches are unregulated. Therefore, this alternative would provide for greater protection of cultural resources, should demand continue to grow. Overall, HRR overnight use would have a direct, beneficial, long-term, negligible to minor effect on cultural resources, compared to current conditions.

The number of noncommercial trips allowed to launch from Diamond Creek would remain unchanged, but trip lengths would be limited to three nights in the peak season and five nights in the non-peak season. This decrease in allowable trip length would limit access to sensitive side canyon archeological sites and traditional cultural properties. Group sizes would remain relatively small, decreasing the likelihood of crowding and its associated effects at attractions and campsites. Compared to current conditions, noncommercial use would have direct, beneficial, long-term, minor to moderate effects on localized resources.

Physical effects from pontoon use on cultural resources would continue to be limited to the impacts at the launch/takeout area at the Quartermaster traditional cultural property (RM 262). Pontoon operations during the peak season would be limited to 960 passengers per day, which would be substantially higher than now or any known spikes in daily use. Pontoon boat passengers rarely have time for exploration, even in the direct vicinity of the helicopter pad and launch area. While archeological sites do exist in the vicinity of the Quartermaster visitor facilities, these sites are relatively inaccessible due to the overgrowth of vegetation, but they have not been monitored for at least 10 years. Compared to current conditions, pontoon use would have direct, adverse, long-term, negligible to minor effects on localized physical resources at Quartermaster.

Upriver traffic would not be allowed under this alternative above RM 273, exception for pontoon traffic. This use would result in an adverse, long-term, negligible to minor effect to cultural resources compared to current conditions.

Mitigation of Effects

Actions needed to mitigate effects would include all of those discussed on page 545 (increased monitoring, patrols, site stabilization, etc.). While reductions in group sizes and trip lengths would reduce adverse effects compared to current conditions, a monitoring and treatment plan to determine and mitigate impacts from visitation, especially at high-use sites, would be needed, but sufficient, to reduce localized impacts to a minor intensity. Levels of additional education, patrols, and site stabilization would be determined based on the results of the monitoring program.

Cumulative Effects

Specific effects from past, present, and reasonably foreseeable actions are discussed earlier in this chapter. Cumulatively, impacts from the management of Glen Canyon Dam, combined with the effects of past visitation by river and backcountry visitors (and researchers), and the effects of lowering Lake Mead levels, result in measurable changes to localized cultural resources. This results in adverse, long-term, minor to major impacts that are highly localized.

Cumulatively, the effects of Alternative 5 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 5 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.

Conclusion

Based on group sizes, trip lengths, and daily passenger limits for trips launching at Diamond Creek, Alternative 5 would directly contribute to the long-term protection and stabilization of individual cultural resource sites, especially in side canyon and sites frequented by HRR trips. This would result in beneficial, localized, negligible to minor effects that would be highly dependent on site accessibility and vulnerability. However, adverse effects from visitation to nonrenewable cultural resources would continue to be measurable and at times of moderate to major intensity to individual resources. Thus, most of the effects from visitation would be direct, adverse, negligible to moderate, and irreversible. However, because not all cultural resources along the river corridor are readily accessible (or recognizable) to river users, effects would not occur to the majority of resources. Therefore, effects would be localized and highly dependent on accessibility. Effects would continue to occur year-round, with most impacts during summer when more daylight allows additional opportunities for visitors to access sensitive resources. Impacts to cultural resources could be reduced to a minor intensity with reasonable mitigation. Alternative 5 would not result in the impairment of cultural resources in Grand Canyon National Park. Cumulatively, the effects of Alternative 5 on cultural resources, when combined with other past, present, and reasonably foreseeable actions, would be localized, adverse, long term, and minor to major. Alternative 5 would result in a localized, adverse, long-term, minor contribution to these cumulative effects.